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(54) Title: HAND-HELD, BATTERY POWERED CLEANING TOOL WITH STAND

(57) Abstract: A hand held cleaning tool is powered by commonly available batteries. An output shaft of the tool includes an expandable coupling, such as, for example a set of swaging cams. Torque delivery arms radiate outward from the output shaft. For example, the torque delivery arms are carried by a hub. The hub is attached to the output shaft with a pin and acts to secure a power train to a housing of the tool. The torque delivery arms are received in slots or interdental spaces associated with a cleaning head. Torque is delivered to the cleaning head with a reduced stress concentration. The cleaning tool is associated with a compact stand. The stand can be incorporated into a housing of the tool. For example, a battery compartment door can include the stand. Alternatively, the stand can be a separable item. A separable stand can accommodate a plurality of cleaning heads.

HAND-HELD, BATTERY POWERED CLEANING TOOL WITH STAND

Related Applications

[0001] This application is a continuation-in-part of U.S. Patent Application No. [Attorney Docket Number JNOZ 2 00002], filed October 8, 2002 and entitled "HAND-HELD, BATTERY POWERED CLEANING TOOL", and of U.S. Patent Application No. [Attorney Docket No. JNOZ 2 00003], filed October 8, 2002 and entitled HAND-HELD, BATTERY POWERED CLEANING TOOL. Both applications are incorporated herein by reference.

Background

[0002] The invention is related to the art of cleaning tools. The invention will be described in terms of a household cleaning tool, such as, for example, a kitchen or bathroom cleaning tool. However, the invention can be applied to other cleaning, polishing, sanding or similar applications.

[0003] Known battery powered cleaning tools suffer from at least one of the following three drawbacks. They require non-standard power sources or batteries that are not readily available; they include slide-type switches, which are not momentary in nature; and/or they apply torque, and, therefore, stresses, to cleaning heads or brushes at relatively narrow portions of cleaning attachments.

[0004] For example, U.S. Patent No. 5,870,790 to Root, et al. discloses several battery powered scrubbing devices. Each disclosed scrubbing device includes a single rechargeable battery. Root does not disclose the size or type of battery. However, the relative size and shape of the battery shown in the illustrations, as well as a probable power requirement of a scrubbing device, indicate that the battery contemplated by Root is of a type not readily available to the general public.

[0005] Rechargeable batteries have a limited lifetime. Additionally, rechargeable batteries are known to have preferred operating and care conditions. For example, the useful lifetime of some rechargeable batteries is diminished if the batteries are not fully discharged before recharging. Many users of battery powered cleaning tools are unaware of, or are unwilling to devote the required attention to, a rechargeable battery care regime. Therefore, the difficulty in replacing the rechargeable batteries of Root, due to their uncommon nature, may lead to a shortened useful lifetime of the overall device.

[0006] The scrubbing devices of Root also include switches. Root does not disclose the type of switch. However, it appears that the switches disclosed in Root are of the push on/push off or slide type. For example, one switch is disposed at a back end of a scrubbing device. In that position, the switch cannot be reasonably held in an on position while the tool is being used. Non-momentary switches can be problematic in cleaning tools because a distracted user can forget to shut the tool off before placing it, for example, on a counter top. For instance, a user may be distracted, by a telephone or a child, and place a cleaning tool with a spinning cleaning head on a counter top. In that case, the cleaning tool may run across the counter top possibly knocking glasses and dishes to the floor. If, on the other hand, a cleaning tool were to incorporate a momentary switch, the cleaning head would stop moving as soon as the tool was released. Furthermore, the inclusion of a momentary actuation switch in a cleaning tool helps conserve energy. For example, through the use of a momentary switch the tool is de-powered during every pause in the cleaning operation, or whenever the user is not making a conscious effort to actuate the machine. Therefore, battery life is extended.

[0007] Lastly, Root discloses several cleaning heads. The cleaning heads include relatively narrow hexagonally shaped jacks that are received in a hexagonally shaped socket of the cleaning tool main body. Therefore, when the tool is operated, torque is applied with a very short moment arm to the edges and surfaces of the hexagonally shaped jack. Because the torque is applied with a relatively short moment arm, a working cleaning head, such as disclosed by Root, undergoes undue mechanical stresses that can lead to premature aging and, eventually, fatigue and brush failure.

[0008] Similarly, U.S. Patent No. 6,295,681 B1 to Dolah discloses a rotary brush cleaning device including a rechargeable battery enclosed in a power source case, a switch of undisclosed type that appears to be a slide switch, and a plurality of cleaning heads. While Dolah suggests that replaceable batteries may be used, Dolah does not suggest a replaceable battery arrangement that would be adequate to provide the required power, nor does Dolah suggest a brush design that could accommodate replaceable batteries while maintaining an ergonomic form factor and pleasing design. The brushes disclosed by Dolah include base portions that are used to connect the brushes to the main body of the cleaning device. The base portions include L-shaped slots for receiving pins of the cleaning device. While no dimensions are given in either reference, the base

portions of Dolah might be of a larger diameter than the jacks of Root. Therefore, Dolah may deliver torque to the brushes with a slightly larger moment arm. However, the brushes of Dolah include relatively narrow elongated intermediate shafts. The relatively narrow elongated intermediate shafts can undergo undue stress concentration which may lead to premature failure.

[0009] A third reference, U.S. Patent No. 4,137,588 to Sandt, et al. discloses a portable cleaning device. Like Root and Dolah, Sandt discloses a cleaning device having a switch of undisclosed type. However, the switch appears to be a non-momentary slide type. The portable cleaning device includes a rechargeable battery of undisclosed size and type. However, the size and shape of the battery shown in the figures appear to be that of a battery that is not readily available to the general public. The brushes of Sandt appear to receive torque in a manner similar to the brushes of Dolah. That is, while no dimensions are given in any of the references, it appears that the brushes of Sandt receive torque at a slightly larger moment arm than do the hexagonal jacks of Root. However, the brushes of Sandt include relatively narrow shafts where damaging stress due to torque can be concentrated.

[0010] Additionally, neither Root, Dolah nor Sandt disclose or suggest a convenient storage means. Sandt discloses a storage case. However, the storage case is larger than the tool disclosed by Sandt and would occupy an inordinate amount of counter space. Therefore, Sandt suggests mounting the case to a wall. However, installing a case to a kitchen wall for the storage of a kitchen tool may detract from the appearance of the kitchen and represents an amount of labor that many consumers would find inconvenient. Furthermore, many people, such as, for example, tenants, may be prohibited from making such modifications to an apartment or other rented space.

[0011] Therefore, there exists a desire for a battery operated hand-held cleaning tool powered by commonly available batteries. There is a desire for a hand-held cleaning tool that is actuated with a momentary switch that de-powers the tool automatically when the tool is released. Additionally, there is a desire for a cleaning tool that delivers lower stress to cleaning heads thereby extending cleaning head life. Furthermore, there is a desire for a cleaning tool that can be conveniently stored when not in use.

Summary

[0012] A first embodiment of a cleaning system includes a power compartment including, a power source housed within the power compartment, a motor mounted within the power compartment, the motor powered by the power source, a switch for selectively connecting the motor to the power source, and, a power output driven by the motor for delivering power to a device connected to the power compartment, a transmission module selectively connectable to the power compartment, a cleaning head selectively connectable to the transmission module and a stand.

[0013] For example, the power source can include four AA size batteries. The switch can be a momentary switch. The cleaning head can include a cleaning element pretreated with a cleansing agent. Preferably, the power compartment includes a gripping portion sized and shaped to fit comfortably in the hand of a user. The cleaning head can be selectively connected to the transmission module via a swaging cam associated with an output of the transmission, the swaging cam being operative to mate with and retain a mating portion of the cleaning head. Additionally or alternatively, the cleaning head can be selectively connected to the transmission module via an output hub associated with an output of the transmission, the output hub including a torque arm, the toque arm being operative to be received within interdental spaces of torque teeth of the cleaning head when the cleaning head is connected to the transmission module, the torque arm thereby providing a moment arm for the delivery of torque to the cleaning head. The stand can be molded to and unitary with a component of the cleaning system. For example, the stand can be incorporated in a battery compartment door.

[0014] A second embodiment takes the form of a cleaning wand configured for hand-held cleaning. The cleaning wand includes an elongated power compartment. A power source is housed within the power compartment. A motor is mounted within the power compartment. The motor can be selectively connected to the power source. The power compartment also houses a power output driven by the motor for delivering power to a device connected to the power compartment. The cleaning wand also includes an elongated transmission module having threads for selectively connecting the transmission module to or disconnecting the transmission module from the power compartment. The transmission module includes a mechanism for transforming power from the power

output to a form selected for a particular cleaning task. The cleaning wand can drive a cleaning head. A switch for selectively connects the motor to the power source.

[0015] For example, the cleaning head can be connected to the cleaning wand via an expandable coupling received in a socket of the cleaning head. For instance, the expandable coupling can be a swaging cam. The switch can include a switch support mounted to a back end of the motor and a resiliently biased arm mounted too the switch support. For instance, the resiliently biased arm can be resiliently spaced, in an over lapping manner, from a power terminal of the motor. The switch can further include a flexible membrane sealingly engaging an aperture in the power compartment. The membrane is positioned in overlapping relation with the resiliently biased arm. Deflecting the membrane caused the resiliently biased arm to deflect and come into contact with the power terminal of the motor. The stand can be molded to and unitary with a component of the cleaning wand. For example, the stand can be incorporated in a battery compartment door.

[0016] A third embodiment includes a cleaning system comprising a handle, a power source housed within the handle, an upper housing selectively connectable to the handle, a transmission mounted within the upper housing, a motor mounted to a power input portion of the transmission, a contact holder mounted to a back end of the motor, a switching element mounted to the contact holder, the switching element being resiliently bias away from a power contact of the motor, a hub connected to an output of the transmission, and a cleaning head selectively connectable at the hub.

[0017] For example, the power source can include four AA size batteries. The switch can be a momentary switch. The cleaning head can include a cleaning element pretreated with a cleansing agent. Preferably, the handle includes a gripping portion sized and shaped to fit comfortably in the hand of a user. The cleaning head can be selectively connected to the transmission via a swaging cam associated with an output of the transmission, the swaging cam being operative to mate with and retain a mating portion of the cleaning head. Additionally or alternatively, the cleaning head can be selectively connected to the transmission via an output hub associated with an output of the transmission, the output hub can include a torque arm, the toque arm being operative to be received within interdental spaces of torque teeth of the cleaning head when the cleaning head is connected to the transmission module, the torque arm thereby providing

a moment arm for the delivery of torque to the cleaning head. The stand can be molded to and unitary with a component of the cleaning system. For example, the stand can be incorporated in a battery compartment door.

[0018] A fourth embodiment takes the form of cleaning wand configured for hand-held cleaning. The cleaning wand includes an elongated handle. The wand includes a power source housed within the handle, an elongated upper housing including threads for selectively connecting the upper housing to or disconnecting the upper housing from the handle, a mechanism for transforming input power to a movement selected for a particular cleaning task, a motor mounted to the mechanism for providing input power to the mechanism. A switch selectively connects the motor to the power source. The wand also includes a cleaning head and an interconnect for selectively connecting the cleaning head to a movement output of the mechanism. The stand can be molded to and unitary with a component of the cleaning wand. For example, the stand can be incorporated in a battery compartment door of the housing.

[0019] The wand can include a battery charging circuit. The interconnect can include an expandable coupling for being matingly received in a socket of the cleaning head. For example, the expandable coupling can include a swaging cam. The switch can include a switch support mounted to a back end of the motor a conductive resiliently biased arm mounted too the switch support, the resiliently biased arm being resiliently spaced, in an over lapping manner, from a power terminal of the motor. The stand can be molded to and unitary with a component of the cleaning wand. For example, the stand can be incorporated in a battery compartment door.

[0020] A fifth embodiment is considered to be an ergonomic, hand held, battery powered cleaning tool. The cleaning tool includes a detachable cleaning head, a generally cylindrical housing, a battery located in a battery compartment in the housing, an electric motor located in the housing, a contact holder mounted to the motor, the contact holder including contacts for receiving power from the batteries and a switch element in overlapping relation to a motor contact. The switch element is resiliently biased away from the motor contact. The cleaning tool further includes an output shaft, and a transmission for coupling the motor to the output shaft. The output shaft extends

outside the housing. The cleaning tool also includes means for attaching the detachable cleaning head to the output shaft.

[0021] The means for attaching the detachable cleaning head to the output shaft can include a swaging cam molded into the output shaft and a socket for receiving the swaging cam, the socket being associated with the cleaning attachment. The generally cylindrical housing can include a gripping portion sized and shaped to fit comfortably in the hand of a user. For example, the gripping portion is at least about 3.5 inches in length, thereby allowing the gripping portion to be comfortably cradled in a palm of a user. The gripping portion can be about one inch in width, thereby allowing the fingers of a user to be comfortably wrapped around the gripping portion. The gripping portion is at about 1.4 inches in height, thereby allowing the gripping section to be cradled comfortably in a palm of a user and allowing the fingers of a user to be comfortably wrapped around the gripping portion. A center of the switch can be spaced about 3/4 to about 1 inch from a first end of the gripping portion along a longitudinal axis of the housing, along an upper edge of the housing, so that when a heel of a hand of a user rests comfortably on the upper edge of the power compartment, a thumb of a user can comfortably actuate the switch. The gripping portion can be hollowed for forming a battery compartment for housing the replaceable batteries. The stand can be molded to and unitary with a component of the cleaning tool. For example, the stand can be incorporated in a battery compartment door.

[0022] A sixth embodiment is considered to be an ergonomic, hand held, battery powered cleaning tool. The cleaning tool includes a detachable cleaning head, a generally cylindrical housing including a lower housing including a gripping portion, and an upper housing connected to the lower housing and extending away from the lower housing. An attachment point for the detachable head is located at a distal end of the upper housing. A battery is located in a battery compartment in the housing. An electric motor is also located in the housing. The cleaning tool includes a switch for actuating the cleaning tool by directing power from the battery to the electric motor. The switch is disposed in relation to the gripping portion to allow the switch to be comfortably operated by a finger of a hand gripping the gripping portion. The upper housing being dimensioned to space the detachable cleaning head from the gripping portion and the switch to allow the cleaning tool to be gripped, actuated and the cleaning head to be

brought in contact with a work piece while preventing the work piece from interfering with the hand gripping the gripping portion or the finger operating the switch. Additionally the cleaning tool includes an output shaft, a transmission for coupling the motor to the output shaft, the output shaft extending outside the upper housing at the distal end, and a means for attaching the detachable cleaning head to the output shaft.

[0023] For example, the switch can be a momentary switch. The output shaft can include a swaging cam molded into the output shaft and the cleaning attachment can include a socket for receiving the swaging cam. The gripping portion can be sized and shaped to fit comfortably in the hand of a user. For example, the gripping portion is at least about 3.5 inches in length, thereby allowing the gripping portion to be comfortably cradled in a palm of a user. The gripping portion is at about one inch in width, thereby allowing the fingers of a user to be comfortably wrapped around the gripping portion. The gripping portion is at about 1.4 inches in height, thereby allowing the gripping section to be cradled comfortably in a palm of a user and allowing the fingers of a user to be comfortably wrapped around the gripping portion. The switch can be spaced about 3/4 to about 1 inch from a first end of the gripping portion along a longitudinal axis of the housing, along an upper edge of the housing so that when a heel of a hand of a user rests comfortably on the upper edge of the power compartment, a thumb of a user can comfortably actuate the switch. The stand can be molded to and unitary with a component of the cleaning tool. For example, the stand can be incorporated in a battery compartment door.

[0024] A seventh embodiment is considered to be an ergonomic, hand held, battery powered cleaning tool. The cleaning tool includes a detachable cleaning head, a generally cylindrical housing including a lower housing including a gripping portion, and an upper housing connected to the lower housing and extending away from the lower housing. An attachment point for the detachable head is located at a distal end of the upper housing. A battery is located in a battery compartment in the housing. An electric motor is also located in the housing. The cleaning tool includes a momentary switch for actuating the cleaning tool by directing power from the battery to the electric motor. The momentary switch is disposed in relation to the gripping portion to allow the momentary switch to be comfortably operated by a finger of a hand gripping the gripping portion. The upper housing being dimensioned to space the detachable cleaning head from the

gripping portion and the momentary switch to allow the cleaning tool to be gripped, actuated and the cleaning head to be brought in contact with a work piece while preventing the work piece from interfering with the hand gripping the gripping portion or the finger operating the switch. Additionally the cleaning tool includes an output shaft, a transmission for coupling the motor to the output shaft, the output shaft extending outside the upper housing at the distal end, and a means for attaching the detachable cleaning head to the output shaft.

[0025] For example, the output shaft can include a swaging cam molded into the output shaft and the cleaning attachment can include a socket for receiving the swaging cam. The gripping portion can be sized and shaped to fit comfortably in the hand of a user. For example, the gripping portion is at least about 3.5 inches in length, thereby allowing the gripping portion to be comfortably cradled in a palm of a user. The gripping portion is at about one inch in width, thereby allowing the fingers of a user to be comfortably wrapped around the gripping portion. The gripping portion is at about 1.4 inches in height, thereby allowing the gripping section to be cradled comfortably in a palm of a user and allowing the fingers of a user to be comfortably wrapped around the gripping portion. The momentary switch can be spaced about 3/4 to about 1 inch from a first end of the gripping portion along a longitudinal axis of the housing, along an upper edge of the housing so that when a heel of a hand of a user rests comfortably on the upper edge of the power compartment, a thumb of a user can comfortably actuate the momentary switch. The stand can be molded to and unitary with a component of the cleaning tool. For example, the stand can be incorporated in a battery compartment door.

[0026] An eighth embodiment takes the form of a durable cleaning tool. The durable cleaning tool includes a housing having a power compartment for holding a power source, a motor mounted within the housing, a switch for selectively connecting the motor to the power source if the power source is installed within the compartment, an output shaft, extending from within the housing to outside the housing, the output shaft being powered directly or indirectly by the motor, torque transmission arms extending radially outward from the portion of the output shaft extending outside the housing, a cleaning head, and, torque receiving elements associated with the cleaning head for receiving torque from the torque transmission arms.

[0027] For example, the cleaning tool further includes a hub attached to the portion of the output shaft extending outside the housing, the hub can carry the torque transmission arms. The torque receiving elements can comprise teeth. The torque transmitting arms can be receivable in interdental spaces between the teeth. The stand can be molded to and unitary with a component of the cleaning tool. For example, the stand can be incorporated in a battery compartment door of the housing.

[0028] Advantages and benefits of the present invention will become apparent to those of ordinary skill in the art upon reading and understanding the following detailed description of the preferred embodiments.

Brief Description of the Drawing(s)

[0029] The invention may take form in various components and arrangements of components, and/or in various procedures and arrangements of procedures. The drawings are only for purposes of illustrating preferred embodiments and are not to be construed as limiting the invention.

[0030] FIG. 1 is a sectional elevation view of a battery powered cleaning tool.

[0031] FIG. 2 is a sectional plan view of the battery powered cleaning tool of FIG.1.

[0032] FIG. 3 is an exploded view of the battery powered cleaning tool of FIG. 1.

[0033] FIG. 4A - 4B are sectional views of working or cleaning heads that can be included in battery powered cleaning tools similar to the cleaning tool of FIG. 1.

[0034] FIG 5A - 5B perspective views of working or cleaning heads that can be included in battery powered cleaning tools similar to the cleaning tool of FIG. 1.

[0035] FIG. 6 is a diagram depicting elements of a means for connecting a working or cleaning head to an output shaft of battery powered cleaning tool of FIG. 1

[0036] FIG. 7 is an elevation view of a battery powered cleaning tool in the hand of a user.

[0037] FIG. 8 is a plan view of the battery powered cleaning tool of FIG. 7 in the hand of the user.

[0038] FIG. 9 is a front elevation in partial cut away of a cleaning system or tool incorporating a combination stand and battery door.

[0039] FIG. 10 is a bottom view of the cleaning system or tool of FIG. 9.

[0040] FIG. 11 is a back elevation of the cleaning system or tool of FIG. 9

[0041] FIG. 12 is an exploded view of a combination stand and battery door further including a spring contact.

[0042] FIG. 13 is an orthogonal view of a first separable stand.

[0043] FIG. 14 is an orthogonal view of a second separable stand.

Detailed Description of the Preferred Embodiments

[0044] Referring to FIG. 1 – FIG. 3, an ergonomic battery operated cleaning tool **100** includes a housing **102** and a cleaning head **104**. The housing can be divided into sections. For example, the housing **102** includes a lower housing or power compartment **106** and an upper housing or transmission module **108**. The lower housing **106** and the upper housing **108** include threads **110, 112**, respectively. The threads **110, 112** are used to connect the upper housing or transmission module **108** to the lower housing or power compartment **106**. The lower housing or power compartment **106** is sized to accommodate at least one readily available battery. For example, the power compartment can be sized to accommodate AAA, AA, C, D or 9V batteries. Both disposable and rechargeable batteries are available in these sizes. Additionally, chargers for these size rechargeable batteries are also readily available.

[0045] The exemplary lower housing or power compartment **106** is sized to accommodate four AA size batteries. Sizing the power compartment to accommodate four AA size batteries **114** allows the lower housing or power compartment to include an ergonomic gripping portion **116** while providing a six-volt power source with a 3,000 milliamp-hour (mA-hr) capacity (assuming commonly available alkaline-manganese dioxide cells are used).

[0046] Other power sources may be selected. However, selecting other power sources may require a reduction in the ergonomic features of the cleaning tool **100** in general and the gripping portion **116** in particular. For example, accommodating C-type or D-type batteries may require the gripping portion **116** to be wider. Additionally, accommodating the larger cells (C type, D type) might require a more complicated construction. If, for example, the power source included two C-type batteries, it might be necessary to run a wire from a contact at a bottom end **118** to a first motor terminal **120**.

[0047] In an embodiment sized to accommodate four AA batteries, a spring contact plate **122** located at the bottom end **118** of the housing **102** is held in place by a spring

contact cover **123**. For example, the spring contact cover snaps into a groove inside the bottom end **118** of the housing. The spring contact cover may include markings to indicate proper battery orientation. Alternatively, the spring contact plate **122** and/or cover **123** may be glued into place. The sprint contact **122** completes a series connection of the four AA batteries **114**. Therefore, four properly installed batteries **114** provide positive and negative power delivery terminals **124, 126** from the batteries themselves at a convenient location within the housing **102**.

[0048] Power is taken from the power delivery terminals **124, 126** and delivered to a motor **128** via contacts **130, 132**. The contacts **130, 132** are supported by a contact holder **134**. The contact holder **134** can be secured to the housing **102**. For example, the contact holder **134** can be mounted to the lower housing or power compartment **106** with an adhesive or fastener.

[0049] In the exemplary embodiment, the contact holder **134** is mounted to the motor **128**. For example, fasteners, such as screws **136** are used to secure the contact holder **134** to a back end **138** of the motor **128**. As will be explained in greater detail below, in the illustrated embodiment, the motor is associated with the upper housing **108**. Therefore, the contact holder **134** is not mounted to the lower housing. Instead, the contact holder **134** (along with a portion of the motor **128**) is simple slide into position within the lower housing **106**. A keying arrangement (not shown), such as, for example, a tongue molded into the lower housing **102** and a groove included in the contact holder **134**, ensures that the contact holder **134** is installed in a proper orientation and prevents the contact holder **134**, as well as the motor **128** from rotating within the housing **102** during operation. For example, the keying arrangement ensures that the contacts **130, 132** line up with and engage the power terminals **126, 124** respectively.

[0050] However, the contact holder **134** is mounted, it is sandwiched between the motor **128** and the positive and negative power delivery terminals **124, 126** of the set of batteries **114**. The first contact **130** is positioned on the contact holder so as to provide a connection between, for example, the negative power delivery terminal **126** and the first motor terminal **120**. The switch contact **132** is positioned and supported by the contact holder **134** to be in contact with, for example, the positive power delivery terminal **124**. The switch contact **132** overlaps either a second motor terminal **140** or a contact plate **142**, which is, for example, pressed in contact with the second motor terminal **140** by the

contact holder **134**. The switch contact **132** is resiliently biased away from the second motor contact **140** and/or the contact plate **142**. The contact holder **134** is positioned and oriented, for example by the keying arrangement (not shown) so the switch contact **132** is adjacent a switch aperture **144** in the housing **102**. For example, the aperture **144** is in the lower housing or power compartment **106**. A button **146** is mounted adjacent the spring contact **132**. For example, the button is made of a resilient material such as rubber, plastic or spring metal. Preferably, the button **146** seals the aperture **144**. Pressing the button **146** brings the button **146** into contact with the spring contact **132** and presses it against the second motor contact and/or the contact plate **142**, thereby completing the power circuit and delivering power to the motor **128**.

[0051] The motor **128** is mounted to the housing **102**. For example, where the contact holder **134** is secured to the lower housing or power compartment **106**, the attachment of the motor **128** to the contact holder **134** by the screws **136** may be sufficient to secure the motor **128** to the lower housing or power compartment **106**. Alternatively, additional bracketing, fasteners or adhesives may be used to secure the motor **128** to some part of the housing **102**.

[0052] In the exemplary embodiment, the motor **128** is indirectly mounted to the upper housing or transmission module **108**. For example, a motor mount **148** is secured to the motor **128** with fasteners, such as screws **149**. Alternatively, adhesive can be used to secure the motor mount **148** to the motor **128**. The motor mount **148** includes tabs or swaging cams **150**. The tabs **150** are received or snap fit into slots **152** in a peripheral gear housing **154**. The peripheral gear housing **154** includes gear teeth (not shown) on an inner wall (not shown) thereof. An outer bushing **156** is secured within the peripheral gear housing **154**. For example, the outer bushing **156** is made of metal. For example, the outer bushing is friction fit or glued into the peripheral gear housing **154**. An inner bushing **157** is friction fit, glued or otherwise fastened to a portion of a transmission output shaft **158**. The transmission output shaft **158** and inner bushing 157 are installed within the outer bushing **156** and peripheral gear housing **154**. An outer surface of the inner bushing **157** engages the inner surface of the outer bushing **156**. A lubricant such as grease or petroleum jelly may be included therebetween. The peripheral gear housing **154** and associated components are inserted into the upper housing or transmission module **108**. When so installed, an output portion **160** of the output shaft **158** extends

through the peripheral gear housing **154** and an output aperture **162** at a distal end **164** of the upper housing or transmission module **108**. A seal **166** installed around the output portion, between the output portion **160** and the output aperture **162** prevents liquids and debris from entering the housing **102**. A pin **168** secures a hub **170** to the output portion **160** of the transmission output shaft **158**. The pin **168** extends through a first mounting aperture **172** in a shaft collar **174** of the hub **170**. The pin **178** also extends through a second mounting aperture **176** in the output portion **160** of the transmission output shaft **158**. The pin **168** is held in place by friction fit or adhesive. Alternatively, the pin **168** is a cotter pin, screw, or other fastening means.

[0053] The transmission output shaft is connected to an output **178** of the motor **128** by a mechanism or transmission **180**. For example, a pinion gear **182** is mounted to an output shaft **184** of the motor **128**. The pinion gear **182** mates with the first set of planetary gears **186**. The first set of planetary gears **186** are supported by a first gear holder **188** and held in place by a gear retainer plate **187**. The first gear holder **188** includes a second pinion gear **190**. The second pinion gear **190** mates with the second set of planetary gears **192**. The second set of planetary gears **192** are supported by a second gear holder **194** and held in place by a flange portion of the first gear holder **188**. The second gear holder **194** is attached to the transmission output shaft **158**. For example, the second gear holder **194** is molded to in unitary width a proximal end **196** of the transmission output shaft **158**. An alignment bushing **197** is installed in or molded into the second gear holder **194** or proximal end **196** of the transmission output shaft **158**. The alignment bushing **197** is coaxial with the transmission output shaft **158**. An alignment pin **198** is received in alignment apertures **200, 201** in the first pinion gear **182** and the alignment bushing **197**. The alignment pin **198** is coaxial with and aligns the motor **128**, first pinion gear **182**, first gear holder **188**, and second gear holder **194**.

[0054] Alternatively, the alignment pin may be an additional molded and unitary component of the transmission output shaft **158**. For example, when the motor **128** is mounted in the lower housing **106**, modular assembly of the cleaning tool **100** is facilitated by including the alignment pin **198** as a molded-in component of the transmission output shaft **158**.

[0055] In operation, when the button **146** is depressed, the resilient biasing of the switch contact **132** is overcome and the switch contact **132** engages the second motor

terminal **140** or the contact plate **142** thereby completing the power circuit and delivering electrical energy from the batteries **114** to the motor **128**. The motor output shaft rotates at a motor output speed. The first set of planetary gears **186** is engaged with the first pinion gear **182** and the gear teeth (not shown) of the peripheral gear housing **154**. The rotation of the motor output shaft **184** causes the first pinion gear **182** to rotate. The rotation of the first pinion gear **182** causes the first set of planetary gears **186** to revolve around the first pinion gear **182** and drive the first gear holder **188** at a reduced speed and with an increased torque according to a first gear ratio between the first pinion gear **182** and the first planetary gears **186**. Similarly, the second pinion gear **190** is driven by the rotation of the first gear holder **188**. The rotation of the second pinion gear **190** causes the second set of planetary gears **192** to revolve around the second pinion gear **190** and drive the second gear holder **194** to rotate at a further reduced speed and a further increased torque according to a second gear ratio between the second pinion gear **190** and the second planetary gears **1192**. The rotation of the second gear holder **194** causes the attached transmission output shaft **158** to rotate. The rotation of the transmission output shaft **158** causes the hub **170** to rotate as well as any attached cleaning head **104**.

[0056] Cleaning heads, such as, for example, cleaning head **104** are held in place by swaging cams **202**. The swaging cams are attached to the transmission output shaft **158**. For example, the swaging cams are molded to and unitary with a distal end **204** of the transmission output shaft **158**.

[0057] It can be important to prevent water and other contaminants from entering the housing **102** of the cleaning tool **100**. Therefore, as mentioned above, the cleaning tool includes the seal **166** for preventing water and contaminants from entering the housing **102** near the point where the transmission output shaft **158** extends out of the housing **102**. An o-ring **203** seals the peripheral gear housing **154** against an inner wall of the upper housing or transmission module **108**. Additionally, as explained above, the button **146** performs a sealing function. Alternatively, the button **146** may have additional sealing components associated therewith. If the housing **102** includes a plurality of sections, such as, for example, lower housing or power compartment **106** and upper housing or transmission module **108**, a sealing component, such as a gasket **206**, should be included therebetween. Where the housing **102** includes a removable battery door **208**

for gaining access to a power source or batteries **114**, a sealing element, such as an o-ring **210**, should be included thereon.

[0058] Referring to FIG. 4A, FIG 4B, FIG. 5A and FIG. 5B, a wide variety of work heads, such as cleaning head **104**, can be detachably connected to the hub **170** to complete the cleaning system **100**. For example, the cleaning head **104** can be a pot scrubber **404**, a glass washer **410**, a bottle washer **420**, or a general-purpose brush **430**. Each work head includes elements directed toward a particular task. For example, pot scrubber **404** includes relatively short, stiff and abrasive bristles **440**. It is anticipated that pot scrubbing may be a most demanding application of the cleaning system **100**. For example, pot scrubbing may require that the pot scrubbing head **404** be pressed firmly against the work piece such as, for example, a cooking pot having food particles tenaciously adhered thereto, with a relatively high level of force. Therefore, in order to minimize cleaning head deflection, the pot scrubbing head **404** includes a relatively short stout body **444**. Other work pieces, such as, for example, drinking glasses, are less likely to require the high level of cleaning effort associated with pots. Nevertheless, glassware provides its own set of cleaning challenges. For example, cleaning glasses can include long throats which make the recessed portions difficult to reach. Therefore, the glass washer **410** includes a long, narrow body **448** and somewhat softer bristles **452** as compared to the relatively stiff bristles **440** of the pot scrubber. The long body 448 and relatively soft, bendable bristles **452** allow the glass washer **410** to reach and clean portions of a work piece that may be inaccessible to other work heads.

[0059] The bottle washer **420** includes features that make it preferable for cleaning bottles, such as, for example, baby bottles. Cleaning an individual baby bottle is not likely to be a particularly difficult task. However, where there is one baby bottle, there is likely to be a large number of other baby bottles. Therefore, a useful bottle washer quickly makes contact with all portions of the inner surface of a baby bottle in order to wipe away any residual, dried on milk or baby formula. Therefore, the bottle washer **420** includes a large number of individual brush filaments **464** distributed along a flexible wire shaft **468** and at a distal end **470** of the shaft. The wire shaft **468** is longer than a typical baby bottle. The brush filaments **464** are distributed along a portion of the shaft that is about at least as long as the depth of a typical baby bottle. The brush filaments **464** can be relatively soft and be directed more toward wiping than scraping. The bottle

washer **420** includes short, stout connector portion **472** for connecting the wire shaft **468** to the hub **170**.

[0060] The general purpose cleaning head **430** is of an intermediate length and may combine features of the pot scrubber **404** and, for example, the glass cleaner **410**. For example, it can include the relatively stiff bristles of the pot scrubber **404** and the somewhat softer bristles **452** of the glass cleaner **410**. A body portion **484** of the general purpose cleaning head **430** can be somewhat longer than the short, stout body **444** of the pot scrubber **404**.

[0061] Referring to FIG. 6, with continued reference to FIG. 4A, FIG 4B, FIG. 5A and FIG. 5B, work heads, such as, for example, the cleaning heads **104, 404, 410, 420** and **430** share certain features in common. For example, all the work heads include a connector section **610**. The connector section **610** includes a socket element **164** centered on a longitudinal axis **168** of the cleaning head. The socket includes a beveled leading edge **622** and a beveled trailing edge **624**. Additionally, the connector section **610** includes a ring of torque-receiving teeth **630**. The ring of torque-receiving teeth is concentric with the socket **614** about the longitudinal axis **618** of the cleaning head. In the exemplary embodiment, the socket element **614** is recessed into the cleaning head relative to the ring of torque-receiving teeth **630**. There are, for example, eight torque-receiving teeth in the ring. In some embodiments there are only 4 torque receiving teeth. Between adjacent torque-receiving teeth is an interdental space **634**. In the exemplary embodiment, there are eight interdental spaces **634**. In some embodiments there are 4 interdental spaces. The torque-receiving teeth **630** extend from a ring base **638**.

[0062] As explained above, the connecting hub **170** includes a collar **174** that is fitted over an output portion **160** of transmission output shaft **158**. Pin **168** secures the collar **174** and, therefore, the hub **170**, to the transmission output shaft **158**. The hub **170** also includes, for example, four torque transmission arms **644**.

[0063] During an installation or connection process, the swaging cams **202** of the distal end of the transmission output shaft **204** contact the leading beveled edge **622** of the socket **614**. As mating pressure is increased, the swaging cams **202** are deflected inwardly toward the longitudinal axis **618** of the working head. Eventually, the swaging cams slide over the beveled trailing edge **624** of the socket expanding outward away from the longitudinal axis **618**, firmly engaging an interior shoulder **650** of the socket **614**,

thereby pulling the working head toward the hub **170** and securing the head as part of the cleaning system **100**.

[0064] During this connection or mating process, the torque delivery arms **644** are received within at least some of the interdental spaces **634**. If an initial misalignment does not permit the torque-delivering arms **644** to be received within interdental spaces **634**, then the working head can be twisted slightly until the torque transmission arms **644** and the interdental spaces **638** are properly aligned.

[0065] As explained above, when the transmission output shaft **158** is driven into rotation by the motor **128** and the transmission or drive mechanism **180**, the hub **170** is also driven into rotation by the pin **168** connecting the hub **170** to the transmission output shaft **158**. Therefore, the torque delivering arms **644** are also driven to rotate. By the time a work head is pressed against a work piece, the torque-delivering arms **644** are driven against respective teeth of the torque-receiving ring **630**, and the working head is driven to rotate. The ring of torque-receiving teeth **630** is spaced radially away from the longitudinal axis **618** of the working head. For example, an outer diameter of the ring of torque-receiving teeth **630** can be about 1 inch. The torque transmitting arms **644** extend away from the longitudinal axis **648** of the cleaning system **100**. For example, the torque transmitting arms **644** extend from the hub **174** to an inner wall **652** of the hub **170**. For example, the inner wall **652** and, therefore, a distal end **656** of the torque-delivering arms is at a radius of about ½ inch from a longitudinal axis **648** of the cleaning system **100**. Torque-receiving teeth of the ring **630** are engaged by the torque transmission or delivery arms **644** at the distal end **656** of the arms **644**. The resulting moment arms provide for the delivery of torque to the work head at a reduced level of stress on the torque-receiving elements of the work head as compared to the level of stress delivered in prior art devices. Additionally, an increased radius of connecting elements such as the hub **170** and the connector section **610** of the work head allow additional material to be used in their manufacture, thereby increasing an overall ruggedness of the cleaning system **100** while maintaining an ergonomic design.

[0066] Referring to FIG. 7, the housing **102** has a generally cylindrical shape. However, portions are tapered away from the cylindrical to provide an ergonomically comfortable design. For example, a portion of the housing **102** is tapered to provide the ergonomic gripping portion **116**. For example, the gripping portion **116** can have a

rounded rectangular cross section. Gripping portion **116** has a length **710** at least long enough to allow it to fit comfortably in a hand **714** of an intended user. For instance, the length **710** is between about 3 inches and about 5 inches. In one embodiment, the length **710** is about 3.5 inches. This length provides enough room for four gripping fingers **718** of the hand **714** of the intended user to fit comfortably within the gripping portion **116** while allowing a compact and comfortable overall length for the housing **102**. Similarly, a width **722** and a height **726** of the gripping portion are selected to allow the gripping portion **616** to fit comfortably within a palm **730** of the hand **714** of the intended user and allow the four gripping fingers **718** to wrap comfortably and securely around the gripping portion. Additionally, in the exemplary embodiment, the length **710**, width **722** and height **726** of the gripping portion **116** are selected to allow an internal portion or chamber within the gripping portion **116** to accommodate a power source, such as, for example, four commonly available AA size batteries **114**.

[0067] In the exemplary embodiment, the width **722** of the gripping portion is about one inch in width. For example, in one embodiment the width of the gripping portion **116** is tapered. The width of that gripping portion **116** varies from about 0.98 inches to about 1.1 inches. The height **726** of the gripping portion is about 1.4 inches. For example, in one embodiment the height of the gripping portion **116** is tapered. The height of that gripping portion **116** varies from about 1.34 inches to about 1.525 inches.

[0068] The actuating button **146** is adjacent to a first or proximal end **731** of the gripping portion **116**. The button **146** is positioned so that a thumb **734** of the hand **714** gripping the gripping portion **116** can comfortably actuate the cleaning system **100** by pressing the button **146**. For example, a center **738** of the button **146** is spaced **742** from the first end of the gripping portions **116** by about ¾ of an inch to about 1 inch. It should be noted that the designation of the location of the first end of the gripping portion is somewhat arbitrary. Some observers consider the button **146** to be within a differently defined gripping portion of the cleaning system **100**. The description above is intended to be exemplary only and is not intended to limit the invention.

[0069] When the housing **102** includes a plurality of sections, such as the lower housing or power compartment **106** and the upper housing or transmission module **108**, the cleaning system **100** can be readily adapted to particular cleaning tasks. For example, the upper housing or transmission module **108** can have a length **750** that is relatively

short when the cleaning system **100** is directed toward kitchen cleaning tasks such as the washing of dishes, glasses and pots and pans. One embodiment directed toward these tasks includes an upper housing having a length **750** of about 2-1/2 inches.

[0070] When the cleaning system **100** is directed toward other tasks, the upper housing **108** can include features directed toward those tasks. For example, when the cleaning system **100** is directed toward cleaning a shower or bathtub area, the length **750** of the upper housing **108** can be longer. For instance, the length **750** of the upper housing **108** can be selected to give the overall cleaning system **100** a longer reach. For example, overall cleaning system lengths of about 14 inches to about 40 inches can be directed toward using the cleaning system to reach across a tub to clean walls adjacent thereto or to clean the tub itself without stooping or kneeling. Other sizes can accommodate the cleaning of a sink or other bathroom fixtures.

[0071] When the housing **102** includes, for example, a lower housing **106** and an upper housing **108**, the cleaning system can be further adapted to particular cleaning tasks. For example, pot scrubbing may benefit from high torque being delivered to the cleaning head. On the other hand, bottle washing may benefit from high-speed brush rotation. Bathroom bowl cleaning may benefit from a slow brush rotation speed. Accordingly, an upper housing with a higher torque motor or a transmission that provides high torque at reduced speed can be installed when the cleaning system is to be directed toward cleaning pots and other items with baked and burned on food. In contrast, an upper housing with a high-speed motor or a lower gear ratio may be used in conjunction with a bottle-washing cleaning head such as bottle washer **420** so that all surfaces of the bottle can be quickly wiped clean and a next bottle can quickly be washed.

[0072] The ergonomic aspects of the cleaning system may be further enhanced by the inclusion of a stand. For example, referring to FIG.9, a lower or bottom end **902** of a cleaning system **904**, otherwise similar to the cleaning system or tool **100**, includes a combination stand and battery door **908**. The combination stand and battery door is dimensioned to provide stable footing for the cleaning system **904**. For instance, the combination stand and battery door **908** is dimensioned so the cleaning system **904** can be stored in an upright position on a kitchen counter. For example, referring to FIG. 10, in one embodiment, the combination stand and battery door **908** includes a generally circular bottom **914**. The generally circular bottom **914** has a radius **918** of about 1.054

inches. A wall **922** of the combination stand and battery door curves away from the generally circular bottom **914** and toward the lower housing **105** with a radius **926** of about 1.063 from a point **930** centered on a longitudinal axis of the cleaning system **904** and spaced **934** about 0.125 inches below the generally circular bottom **914** giving the combinations stand and battery door **908** a generally semispherical shape. However, referring to FIG. 11, a back portion **938** of the combination stand and battery door **908** includes a flattened portion **942**. For example, at the generally circular bottom **914**, the flattened portion **942** is spaced **944** from a front portion **946** of the generally circular bottom **914** by about 1.891 inches and extends upward, away from the generally circular bottom in a manner approximately perpendicular to the generally circular bottom **914**. The flattened portion **942** lies in a plane that is approximately tangent to a widest portion (not shown) of the cleaning system **904**. The flattened portion **942** allows the cleaning tool or system **914** to lie approximately flatly against, for example, a cardboard or other backing to a blister pack product package. Additionally, providing the flattened portion **942** allows the cleaning tool or system **904** to be stored out of the way, close to a wall or other appliance, such as, for example a toaster or microwave oven.

[0073] The combination stand and battery door **908** can be generally hollow to reduce weight and material cost. In that case, a cavity **950** is created within the generally semispherical wall **922**. The cavity **950** can be protected from an accumulation of dirt or debris by a cover **954**. For example the cover **954** can be glued to the rest of the combinations stand and battery door **908**. Alternatively, the cover may include snap fit means **958** for securing the cover **954** to the rest of the combination stand and battery door **908**. Additionally, the cover can include means for mounting spring contacts.

[0074] For example, referring to FIG. 12, a cover **1210** similar to the cover **954** of FIG. 9, includes a first or oval shaped ridge **1214** on an inner surface **1216** thereof. The first ridge is operative to be received in a friction or snap fitting groove (not shown) in a main body **1218** of a combination stand and battery door **1222**. Additionally, the inner surface **1216** of the cover **1210** includes a means for retaining a spring contact **1230**. For example, the means for retaining the spring contact **1230** is a second or figure eight-shaped ridge **1234**. The means for retaining the spring contact **1230** cooperates with apertures **1238** in a bottom wall **1242** of the main body **1218** of the combination stand and battery door **1222** to hold the spring contact **1230** in place. For example the spring

contact **1230** is glued or compression fit within the confines of the second or figure eight shaped ridge **1234**. This cover **1210** and spring contact **1230** assembly is secured to the main body **1218** of the combination stand and battery door **1222,** for example, by gluing or by friction, snap fit or other means. In so securing the cover **1210** to the main body, first and second portions **1240, 1242** of the spring contact **1230** are positioned to extend through the apertures **1238** in the bottom wall **1242** of the main body. Additionally, a linking portion **1244** of the spring contact **1230** is captured or sandwiched between the cover **1210** and the bottom wall **1242**, thereby further retaining the spring contact in place. In this regard, the bottom wall **1242** replaces or serves as a spring contact cover, such as, for example, the spring contact plate or cover **123** of the cleaning tool or system **100** of FIG. 3. In this regard, an inner surface **1250** of the bottom wall **1242** can carry a label or be embossed or etched with markings. For instance, the markings or label can include battery installation or orientation instructions.

[0075] Alternatively, the ergonomic aspects of a cleaning system are enhanced with a separable stand. For example, referring to FIG. 13 a first separable stand **1310** includes a socket **1314** sized and shaped for receiving a cleaning tool or system. For example, the socket is sized and shaped for receiving the bottom end **118** of the cleaning tool or system **100** of FIG. 1- FIG. 3. Other dimensions of the first separable stand **1310** may be similar to those of the combinations stand and battery door **1222**. One embodiment of the first separable stand **1310** includes a collar **1318** extending upward from the socket **1314**. The collar **1318** may provide added stability by preventing the cleaning tool **100** from tipping out of the socket **1314**.

[0076] Referring to FIG. 14 a second separable stand **1410** includes a first socket **1414** sized and shaped for receiving a cleaning tool or system. For example, the socket is sized and shaped for receiving the bottom end **118** of the cleaning tool or system **100** of FIG. 1- FIG. 3. The second separable stand **1410** does not have a generally semispherical shape. Instead, the second separable stand **1410** has a rectangular footprint and a wall **1418** which curves from a first long edge **1422** to a second long edge **1426** to provide the second separable stand **1410** with a semi cylindrical shape. A second socket **1430** and a third socket **1434** are disposed on either side and in spaced relation to the first socket. The second **1430** and third **1434** sockets are sized and shaped to receive the connector sections **610** of work heads.

[0077] The invention has been described with reference to particular embodiments. Modifications and alterations will occur to others upon reading and understanding the specification. It is intended that all such modifications and alterations are included insofar as they come within the scope of the appended claims or the equivalents thereof.

WHAT IS CLAIMED IS:

1. A cleaning system characterized in that it comprises:

a power compartment including:

a power source housed within the power compartment;

a motor mounted within the power compartment, the motor powered by the power source;

a switch for selectively connecting the motor to the power source; and,

a power output driven by the motor for delivering power to a device connected to the power compartment;

a transmission module selectively connectable to the power compartment;

a cleaning head selectively connectable to the transmission module; and,

a compact stand for holding the cleaning system in a convenient and orderly storage position.

2. A cleaning system according to Claim 1 comprising a cleaning wand configured for hand-held cleaning, wherein:

the power compartment is elongated and the motor is selectively connected to the power source; and

the transmission module is elongated and includes threads for selectively connecting the transmission module to or disconnecting the transmission module from the power compartment, the transmission module including a mechanism for transforming power from the power output to a form selected for a particular cleaning task.

3. A cleaning system according to Claim 1 comprising:

a handle including said power compartment, wherein the power source is housed within the handle;

an upper housing selectively connectable to the handle, wherein said transmission module comprises a transmission that is mounted within the upper housing, said transmission comprising a power input portion and an output;

and said motor comprises a back end and a power contact, and said motor is mounted to the power input portion of the transmission;

a contact holder mounted to said back end of the motor;

said switch comprises a switching element mounted to the contact holder, the switching element being resiliently biased away from the power contact of the motor; and

a hub connected to the output of the transmission, wherein said cleaning head is selectively connectable at the hub.

4. A cleaning system according to Claim 1 comprising a cleaning wand configured for hand-held cleaning, the cleaning wand comprising:

an elongated handle including said power compartment, wherein said power source is housed within the handle;

an elongated upper housing including threads for selectively connecting the upper housing to or disconnecting the upper housing from the handle;

a mechanism for transforming input power to a movement selected for a particular cleaning task;

wherein said motor is mounted to the mechanism for providing input power to the mechanism, the motor being selectively connected to the power source; and

an interconnect for selectively connecting the cleaning head to a movement output of the mechanism for transforming input power.

5. A cleaning system according to Claim 1 comprising an ergonomic, hand held, battery powered cleaning tool comprising:

a detachable cleaning head;

a generally cylindrical housing including said power compartment;

wherein said power source comprises a battery located in a battery compartment in the housing;

wherein said motor comprises an electric motor that is located in the housing;

a contact holder mounted to the motor, the contact holder including contacts for receiving power from the battery and said switch comprises a switch element

in overlapping relation to a motor contact, the switch element being resiliently biased away from the motor contact;

an output shaft;

said transmission module comprises a transmission for coupling the motor to the output shaft, the output shaft extending outside the housing; and

means for attaching the detachable cleaning head to the output shaft.

6. A cleaning system according to Claim 1 comprising an ergonomic, hand held, battery powered cleaning tool comprising:

a detachable cleaning head;

a generally cylindrical housing including said power compartment, and

a lower housing including a gripping portion;

an upper housing connected to the lower housing and extending away from the lower housing, an attachment point for the detachable head being located at a distal end of the upper housing;

wherein said power source comprises a battery located in a battery compartment in the housing;

wherein said motor comprises an electric motor located in the housing;

said switch is used for actuating the cleaning tool by directing power from the battery to the electric motor, the switch being disposed in relation to the gripping portion to allow the switch to be comfortably operated by a finger of a hand gripping the gripping portion, the upper housing being dimensioned to space the detachable cleaning head from the gripping portion and the switch to allow the cleaning tool to be gripped, actuated and the cleaning head to be brought in contact with a work piece while preventing the work piece from interfering with the hand gripping the gripping portion or the finger operating the switch;

an output shaft;

said transmission module comprises a transmission for coupling the motor to the output shaft, the output shaft extending outside the upper housing at the distal end; and

means for attaching the detachable cleaning head to the output shaft.

7. A cleaning system according to Claim 1 comprising an ergonomic, hand held, battery powered cleaning tool comprising:

a detachable cleaning head;

a generally cylindrical housing including said power compartment, and

a lower housing including a gripping portion;

an upper housing connected to the lower housing and extending away from the lower housing, an attachment point for the detachable head being located at a distal end of the upper housing;

wherein said power source comprise a battery located in a battery compartment in the housing;

wherein said motor comprises an electric motor located in the housing;

wherein said switch comprises a momentary switch for actuating the cleaning tool by directing power from the battery to the electric motor, the momentary switch being disposed in relation to the gripping portion to allow the switch to be comfortably operated by a finger of a hand gripping the gripping portion, the upper housing being dimensioned to space the detachable cleaning head from the gripping portion and the momentary switch to allow the cleaning tool to be gripped, actuated and the cleaning head to be brought in contact with a work piece while preventing the work piece from interfering with the hand gripping the gripping portion or the finger operating the momentary switch;

an output shaft;

wherein said transmission module comprises a transmission for coupling the motor to the output shaft, the output shaft extending outside the upper housing at the distal end;

means for attaching the detachable cleaning head to the output shaft.

8. A cleaning system according to Claim 1 comprising a durable cleaning tool comprising:

a housing including said power compartment;

wherein said motor is mounted within the housing;

and said switch selectively connects the motor to the power source if the power source is installed within the compartment;

an output shaft, extending from within the housing to outside the housing, the output shaft being powered directly or indirectly by the motor;

torque transmission arms extending radially outward from the portion of the output shaft extending outside the housing; and,

torque receiving elements associated with the cleaning head for receiving torque from the torque transmission arms.

9. The cleaning system according to any of the preceding claims wherein the compact stand is molded to and unitary with a component of the cleaning system, preferably wherein the component of the cleaning system is the power compartment, and more preferably wherein the compact stand comprises a combination stand and battery door of the power compartment.

10. A cleaning system according to any of Claims 1-6 and 8-9 wherein the switch is a momentary switch.

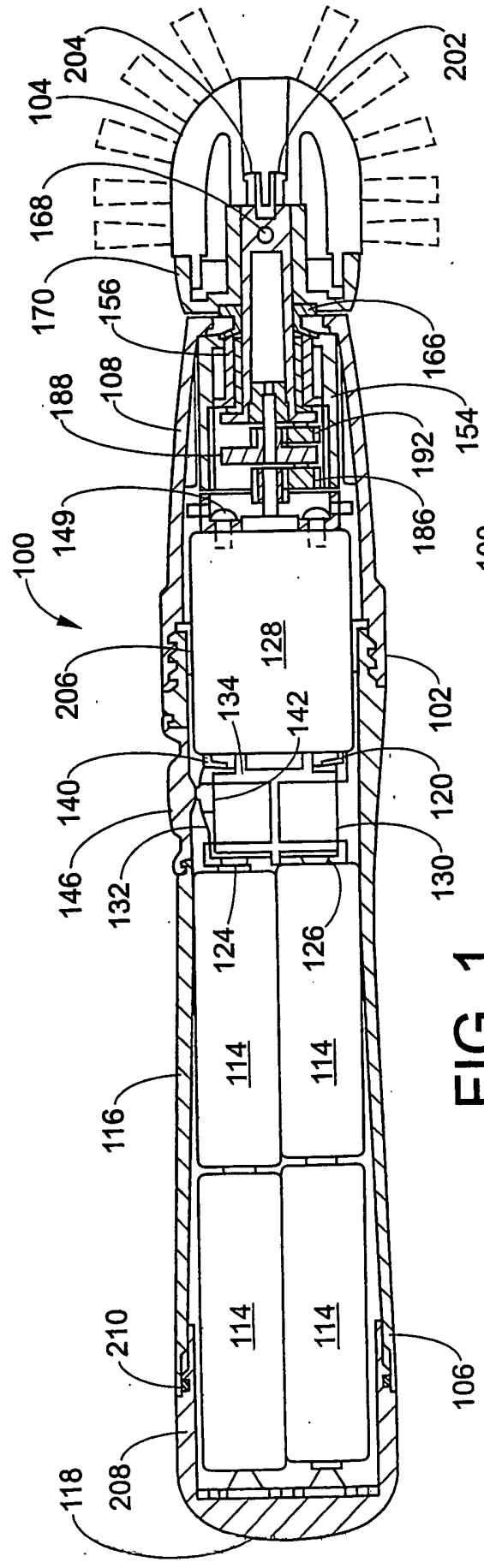
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FIG. 1

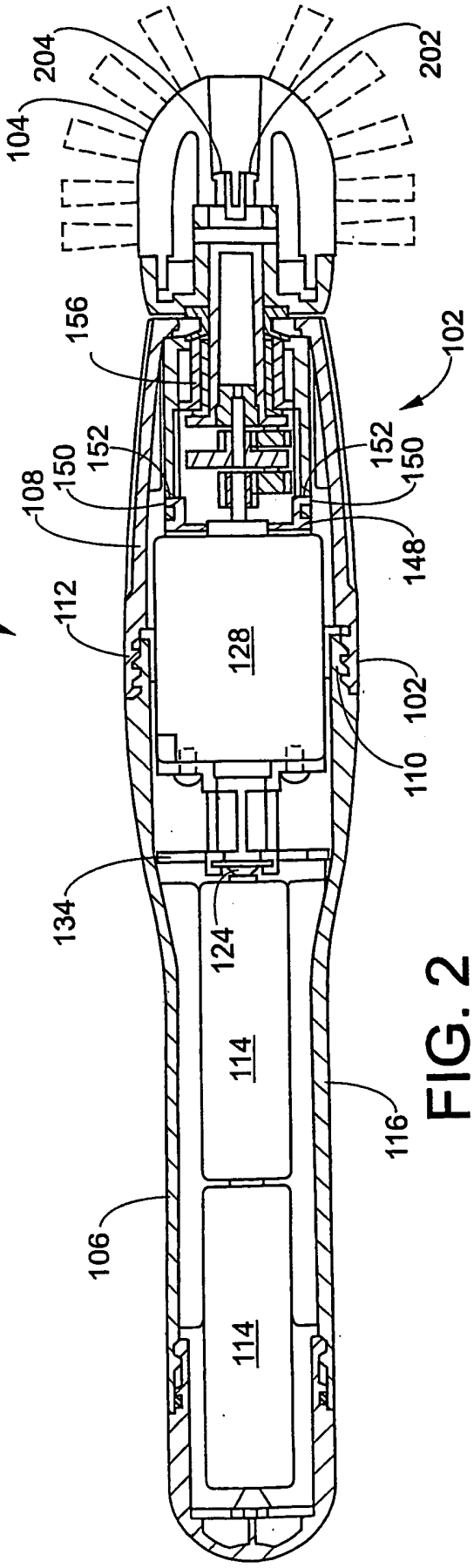
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FIG. 2

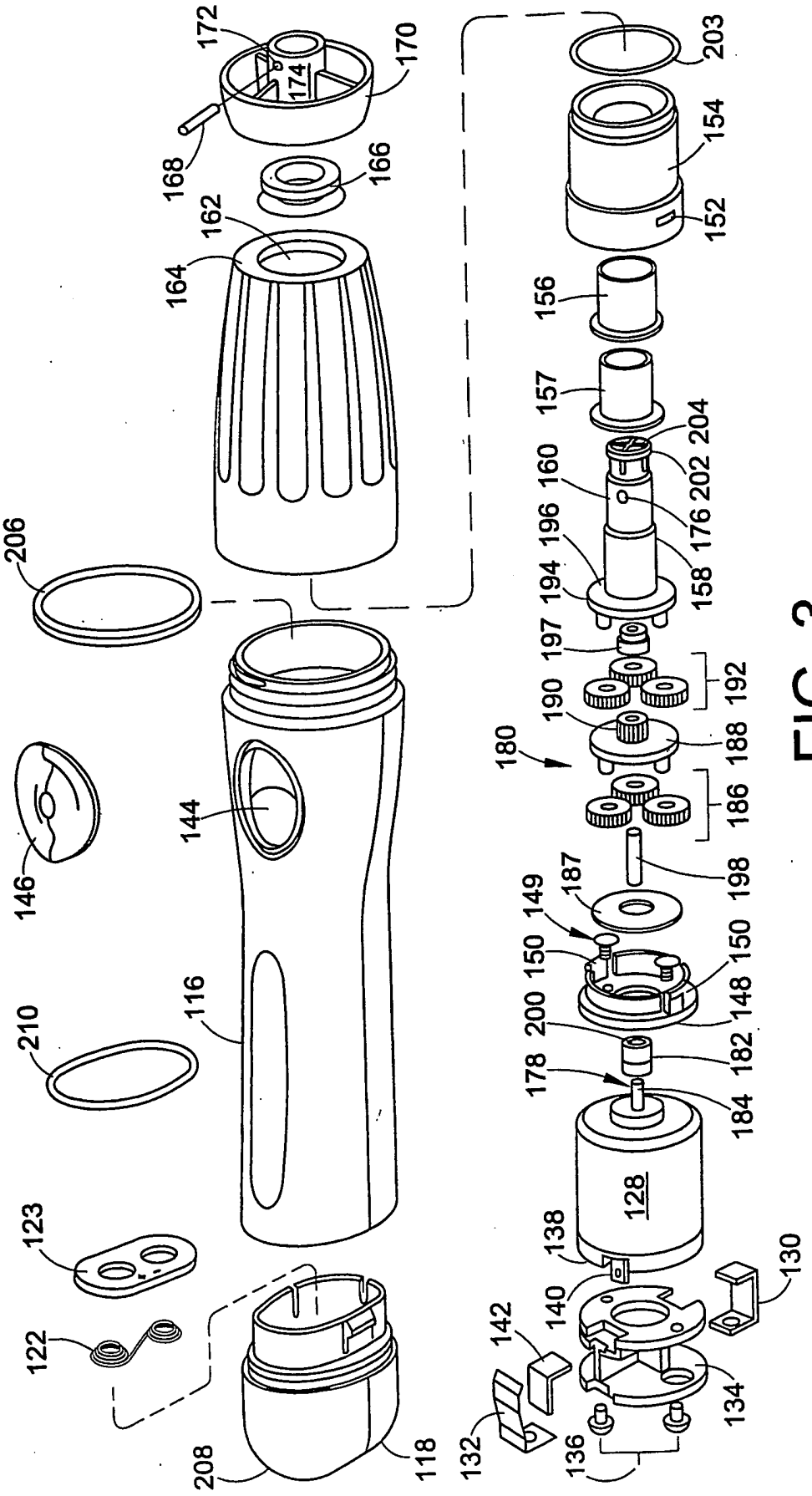
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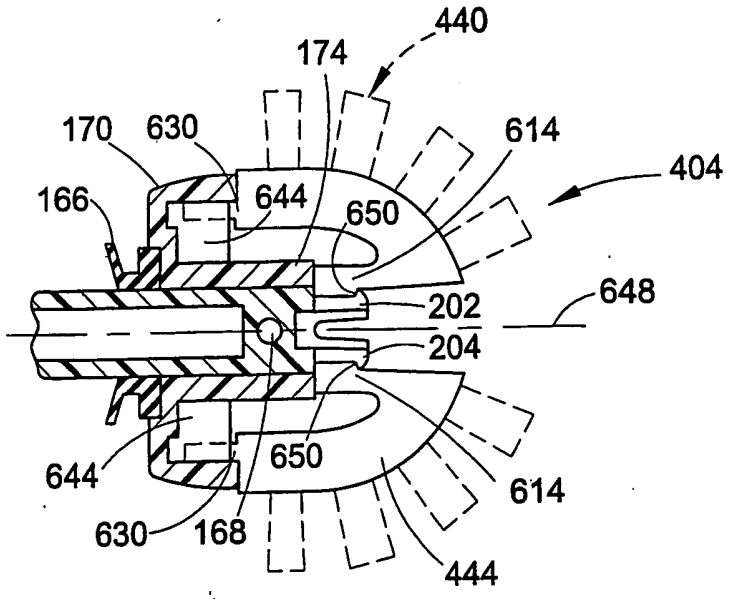
FIG. 3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204
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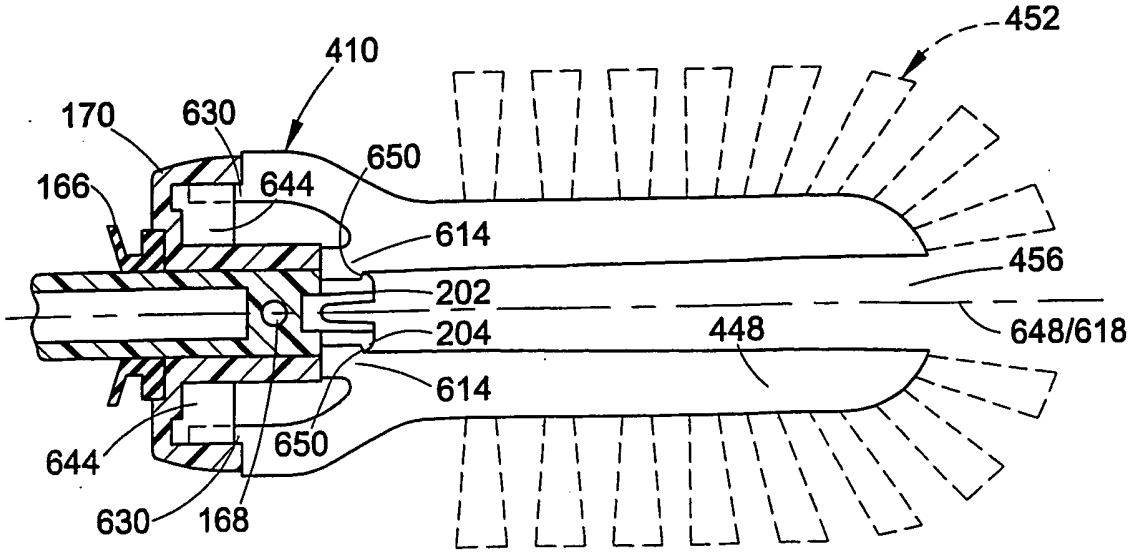
614
630
168
444

FIG. 4A


452
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456
202
204
448
648/618
614
644
650
630
168

FIG. 4B

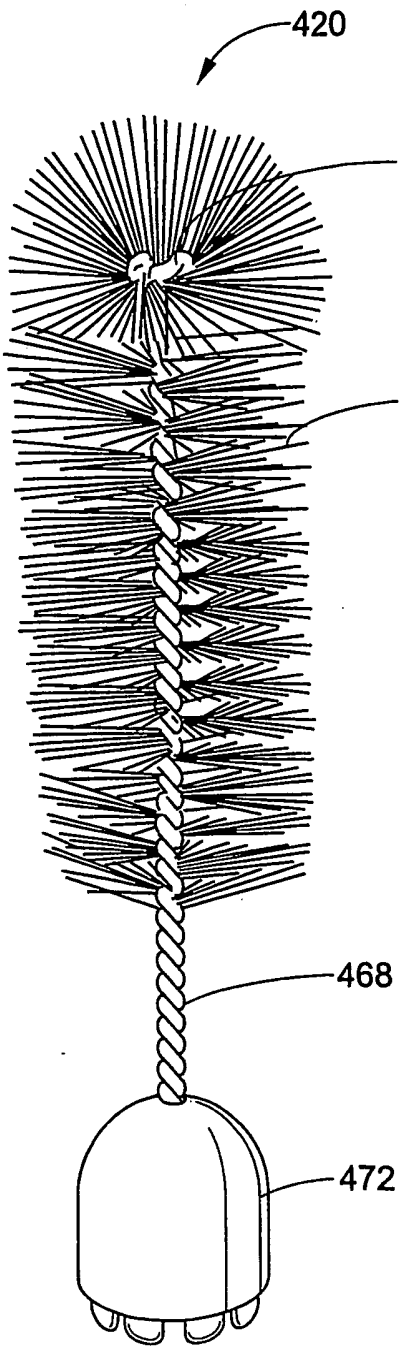

FIG. 5A

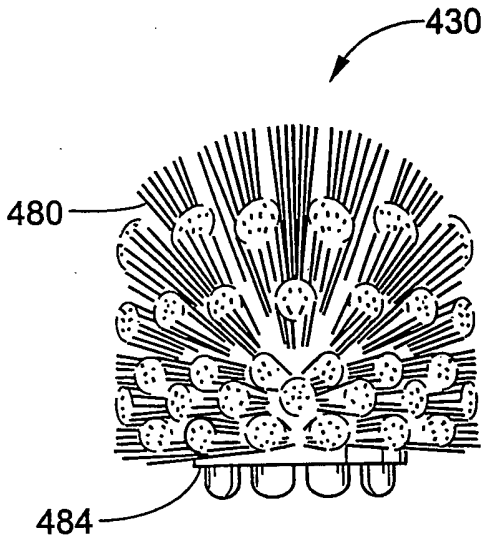

FIG. 5B

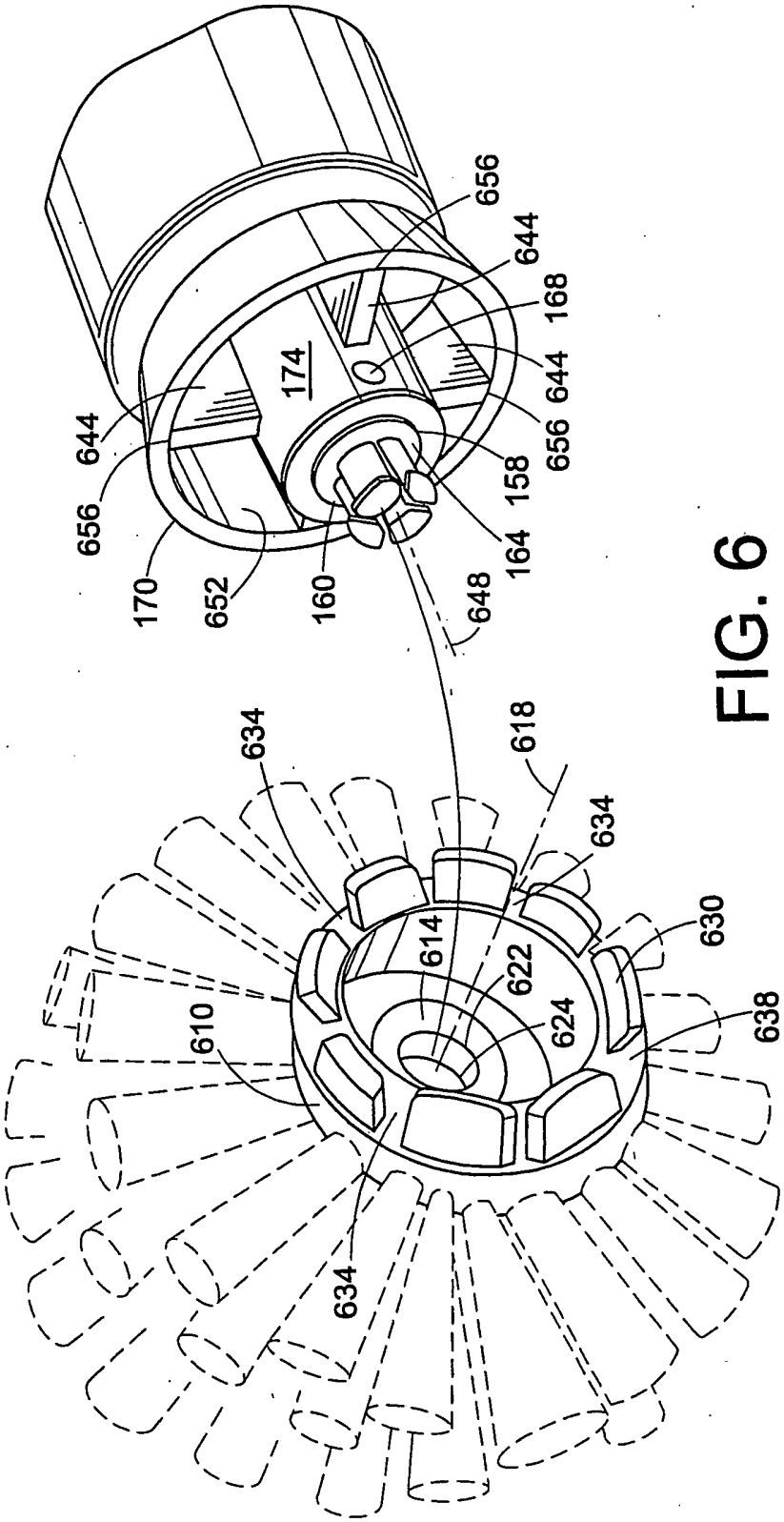
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FIG. 6

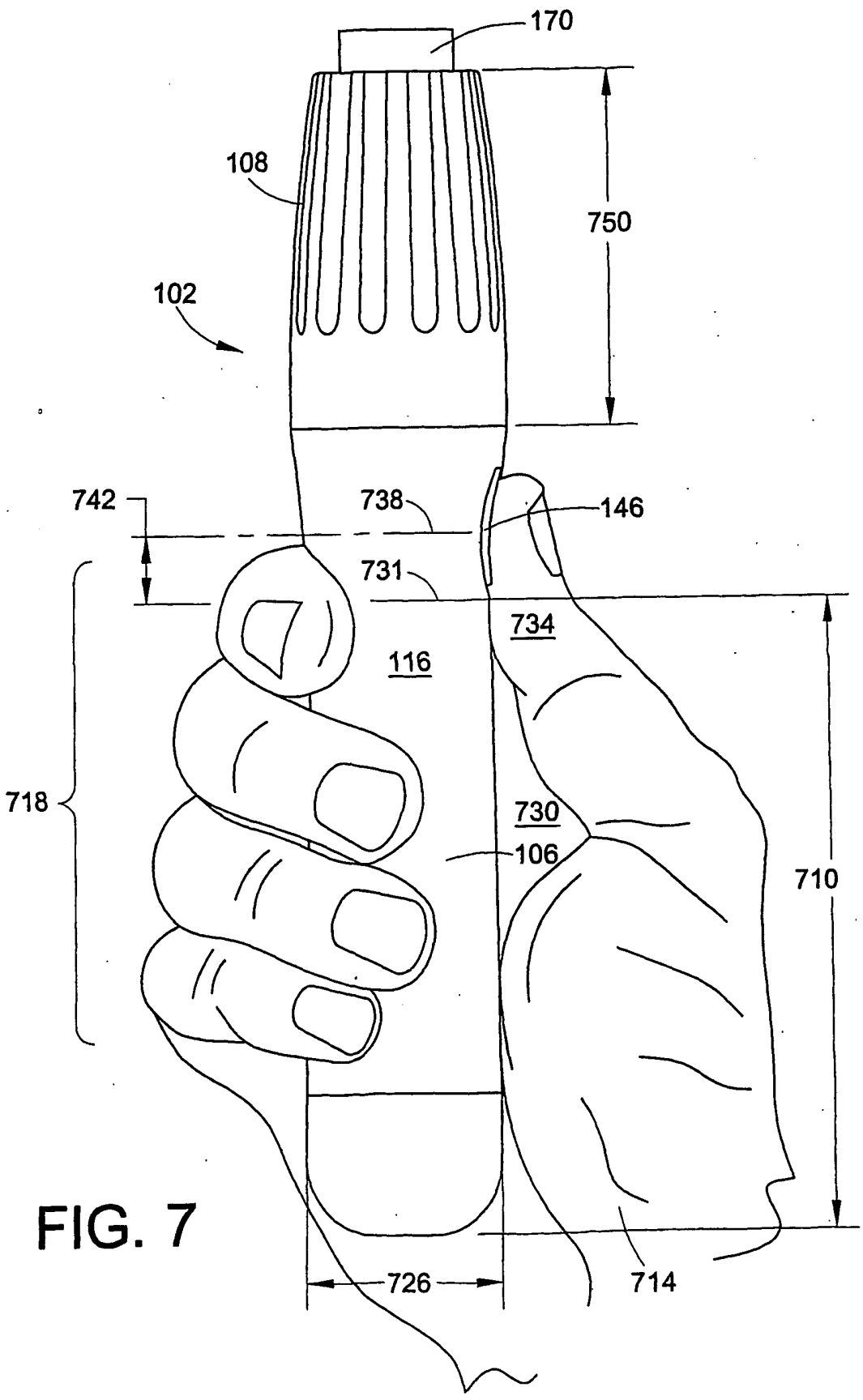
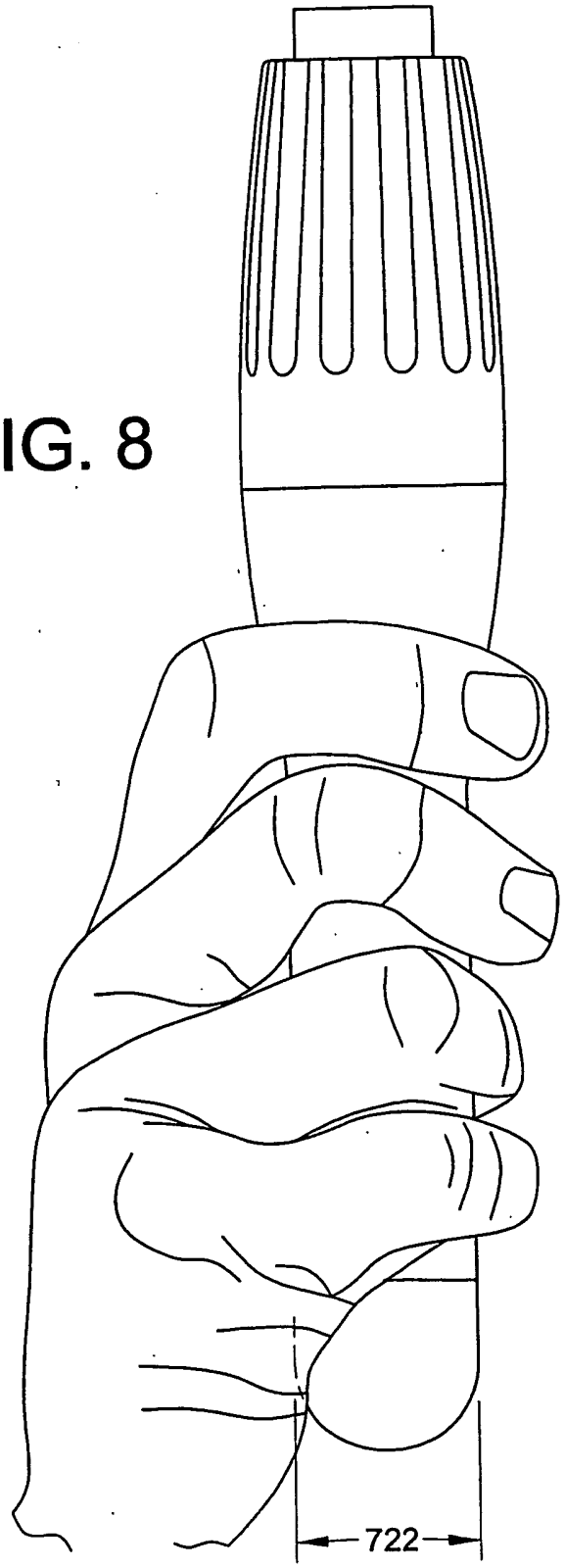


FIG. 7

FIG. 8



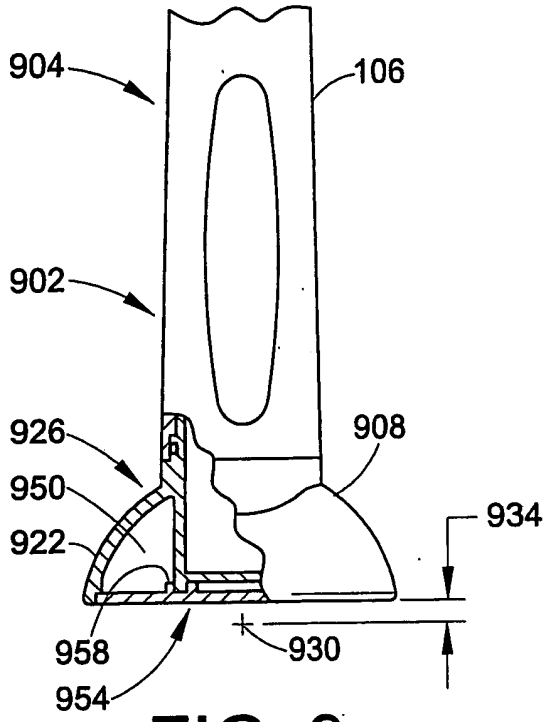


FIG. 9

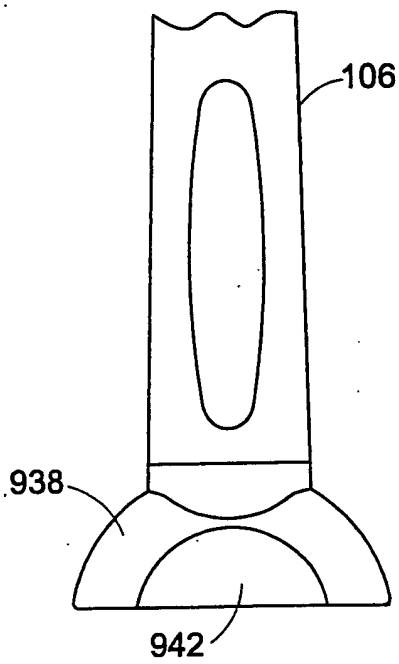


FIG. 11

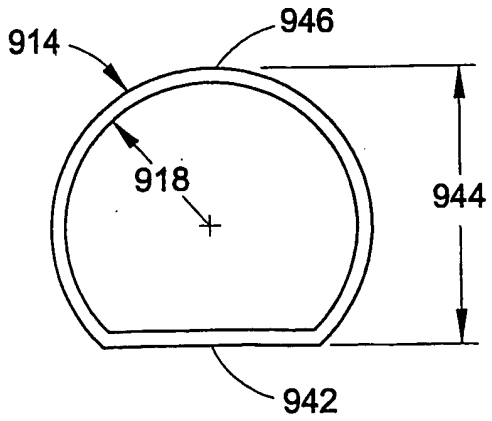


FIG. 10

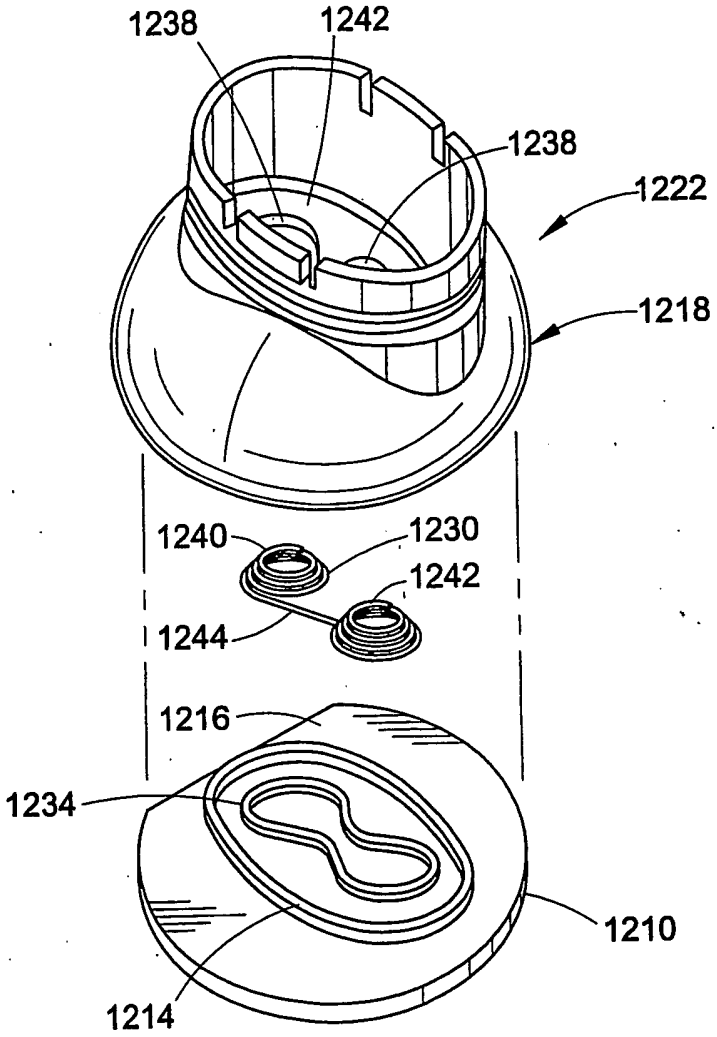

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FIG. 12

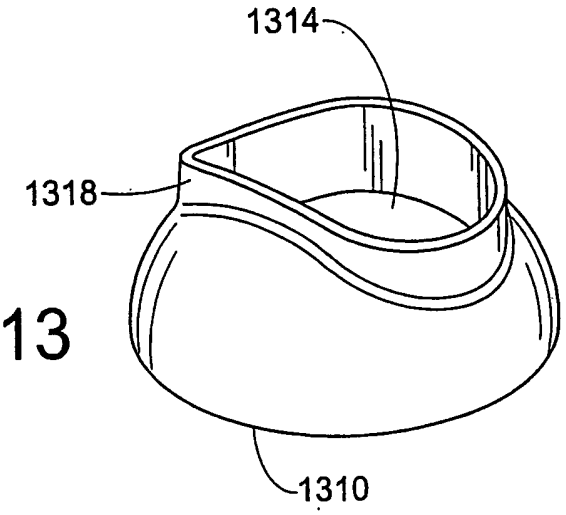

FIG. 13

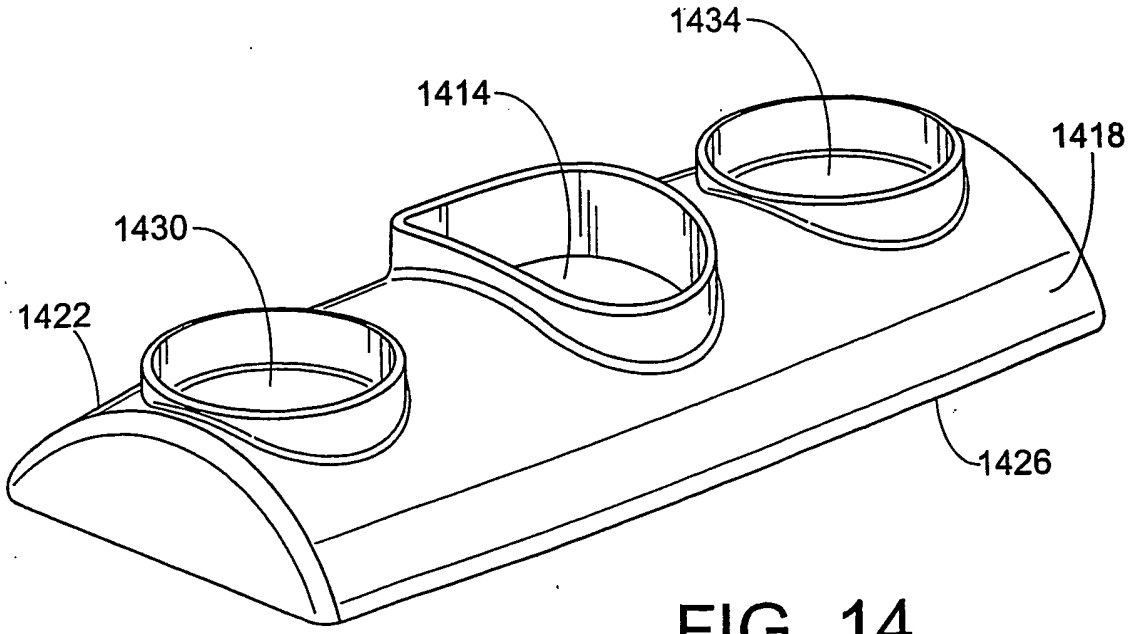

FIG. 14